



Birds of Bosque Protector Jerusalem, Guayllabamba Valley, Ecuador

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Abstract: The Ecuadorian inter-Andean dry valleys are highly affected by human intervention. Currently, less than 5% of the original vegetation cover of these valleys remains on creeks and hillsides. Bosque Protector Jerusalem (1,110 ha), in the upper Guayllabamba River valley, protects the largest remnants of inter-Andean dry forest in Ecuador. Here, we present data derived from two recent studies (from 2009 to 2013), as well as information collected by other authors in previous studies, between the years 2002 and 2009. We present a unified list of 75 species of birds, accounts for species of particular interest, new distributional records, and considerations about the conservation of the study area.

Key words: Andes, dry forest, conservation, Neotropics

INTRODUCTION

Neotropical dry forests are highly threatened because of anthropogenic factors, but also because the conservation interest of this ecosystem has lagged in comparison to that for other forest types (Kricher 2012). The inter-Andean dry forests of Ecuador, in particular, have suffered from continuous degradation caused by agriculture, cattle ranching, urban expansion (Aguirre et al. 2006; Albuja 2011), and wood collection for charcoal production, which have restricted the native vegetation to deep ravines, steep slopes, and scattered and unconnected forests (Guerrón et al. 2005). These Andean forests may be divided into two groups: to the north, the valleys of the Chota and Guayllabamba rivers (Imbabura and Pichincha provinces); to the south, the valleys of the Girón and Paute rivers (Azuay and Loja provinces), and those of the Catamayo, Malacatos, and Vilcabamba rivers (Loja province) (Aguirre et al. 2006). The northern

forests are located at elevations between 1,400 and 2,600 m, and are more isolated from each other, and from other dry forests along Ecuador. The southern forests are at lower elevations (<1,300 m) allowing higher biological exchanges with coastal dry forests (Aguirre et al. 2006).

The Guayllabamba River Valley is an Important Bird Area (IBA) that covers 23,000 ha and includes two protected areas: Bosque Protector Jerusalem (BPJ; 1,110 ha) and the Quito Zoo (12 ha) (Freile and Santander 2005). Both of these areas are among the last protected relicts of highland dry forest in the country (MAE 2013). Previous studies at the BPJ have reported up to 42 species of birds (Trujillo and Trujillo 2002, 2003; Ecuambiente 2007; Lombeida 2009). We update the list of species of the BPJ, after the collection of original data from field research, as well as a review of species lists from previous studies.

MATERIALS AND METHODS

Study site

The BPJ (00°00'17.4" N, 078°21'34.7" W; 2,330 m; Figure 1) is located northeast of Quito, in the Guayllabamba River basin, Pichincha province (MAG 1989). It is a protected forest since 1989 (MAG 1989) and lies on a plateau bordered by the Pisque River, a tributary of the Guayllabamba River, in the southwestern side of the Mojanda volcanic complex (which connects the eastern and western Ecuadorian Andean cordilleras). The ecosystem is classified as semi-deciduous forest and shrubland of the northern valleys (MAE 2013), where there is dominance of algarrobo trees (*Prosopis macracantha*; Fabaceae), abundant epiphytes, and cacti (Freile and Santander 2005). According to data collected between 2000 and 2005 in the closest weather stations, La Victoria (00°03'36" N, 078°12'02" W; 2,262 m) and Malchinguí (00°03'20" N, 078°19'56" W; 2,840 m),

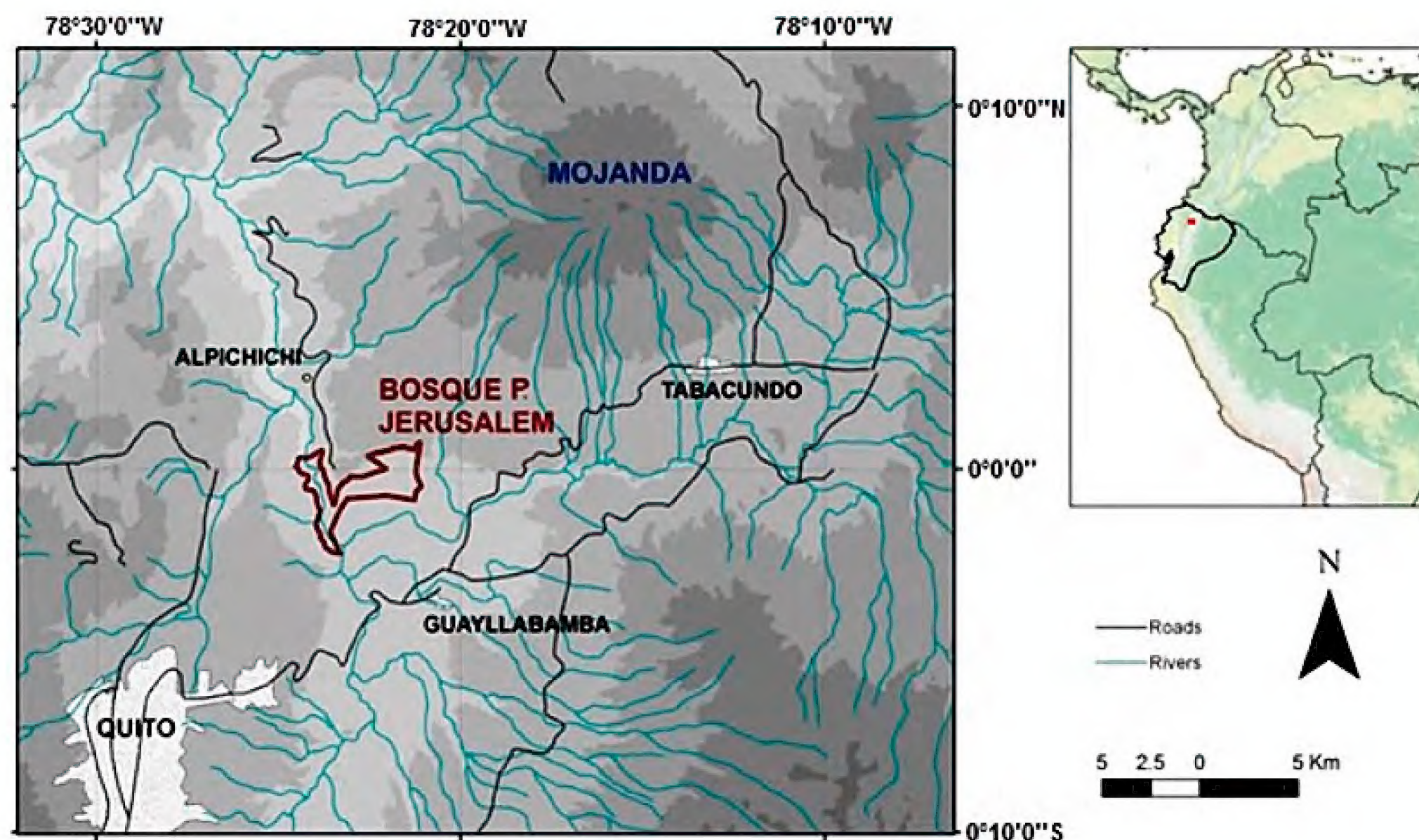


Figure 1. Bosque Protector Jerusalem location and adjacent localities.

the area has a marked seasonal climate, with a dry period from May to August (average annual rainfall of 125 mm) and a rainy period in September to April (average annual rainfall of 360 mm) (Carvajal-Campos 2009).

Data collection

We conducted two independent inventories: one focused specifically on nocturnal birds, the other focused on diurnal birds. SV and JFF studied night birds between April 2011 and March 2012. Three linear transects of 1.2 km-long were established and were walked twice (roundtrip) between 18h30–21h30 and 3h30–6h30. Transects were located across mature forest, secondary woodland and open areas. All birds heard or seen were plotted in transect maps in order to determine the number of territories, spatial distribution, and ultimately, species abundance (Freile and Varela, in prep.). In each trip, the location of vocalizing nocturnal birds was mapped. Each study period lasted six days and this protocol was repeated twice per month, totaling a sampling effort of 3,110.4 h/km.

HC, DB, and EB studied the community of diurnal birds between December 2012 and August 2014. Seven 12-m (36 mm mesh size) mist nets were used in a different site every week for two days. The first day, nets were opened from 6h00 to 18h00; the second day, they were opened from 6h00 to 12h00. From December 2012 to June 2013, four permanent sites (separated by at least 500 m in straight line) were sampled. Mist nets in three of the four sites were placed along the forest and, because of the

general low-height of the forest (3–5 m), we were able to capture both canopy and understory birds. Mist nets in the fourth site were placed within an orchard, to increase the odds of capturing both frugivores and insectivores.

From February to August 2014 multiple sites were sampled, including the four previous permanent sites, new sites within the BPJ, and an adjacent area called La Caldera, an unprotected site outside the southern boundary of the BPJ, which borders the Pisque River (two visits). Summing these two sampling seasons, an effort of 217,728 h/m² was completed. Up to two individuals of the captured species were collected and deposited at the Museo de Zoología Universidad Tecnológica Indoamérica (MZUTI; see Results: Table 1). For species identification of observed and captured birds, we followed Ridgely and Greenfield (2001), and Carrión (2002). Research and collection permits were awarded by the Dirección Provincial de Pichincha, Ministerio del Ambiente, Ecuador, under Research Authorization No. 20-12-IC-FAU-DPAP-MA.

Some photographs obtained during both studies are available at: <http://fm2.fieldmuseum.org/plantguides/guideimages.asp?ID=596>. Field data were supplemented by observations made by JFF within the BPJ, between August 2009 and May 2013, and by Roger Ahlman in December 2009. For vocalization identification, we followed Krabbe et al. (2001) and Xeno-Canto (<http://www.xenocanto.org>). We applied the taxonomy of the South American Classification Committee (Remsen et al. 2014). Further, we revised the species lists reported in

previous studies for the area (Trujillo and Trujillo 2002, 2003; Ecuambiente 2007; Lombeida 2009), in order to compile a thorough and updated species list of the BPJ.

RESULTS

We recorded 68 species, 26 of which were not reported in previous studies. With these data, the list of birds of

the BPJ extends to 75 species, grouped into 26 families (Table 1). The most diverse families are Thraupidae (16 species), Trochilidae, and Tyrannidae (eight species each). The species with more captures in nets during fieldwork was the Rufous-collared Sparrow, *Zonotrichia capensis* (226 individuals), while the most abundant during nocturnal sampling was the Barn Owl, *Tyto alba*

Table 1. List of birds recorded at Bosque Protector Jerusalem.

FAMILY Species ¹	Evidence ² Present study (relative abundance) ³	Trujillo and Trujillo (2002, 2003)	Ecuambiente Consulting Group (2007)	Lombeida (2009)
Ardeidae				
<i>Ardea alba</i> Linnaeus, 1758	V (SV Aug.2011)			
<i>Bubulcus ibis</i> (Linnaeus, 1758)		X	X	X
Cathartidae				
<i>Cathartes aura</i> (Linnaeus, 1758)	V (R)			
<i>Coragyps atratus</i> (Bechstein, 1793)	V (R)	X	X	X
<i>Vultur gryphus</i> Linnaeus, 1758 ^{CR/NT}			X	
Accipitridae				
<i>Parabuteo unicinctus</i> (Temminck, 1824)	R; V; A (U)	X	X	X
<i>Geranoaetus polyosoma</i> (Quoy & Gaimard, 1824)	V (HC Jun.2013)	X	X	X
Columbidae				
<i>Patagioenas fasciata</i> (Say, 1823)	V (U)		X	
<i>Zenaida auriculata</i> (Des Murs, 1847)	V (U)	X	X	X
<i>Leptotila verreauxi</i> (Bonaparte, 1855)	R; V; M (C)			
<i>Columbina passerina</i> (Linnaeus, 1758)	R; V; M (C)	X	X	X
Cuculidae				
<i>Coccyzus melacoryphus</i> Vieillot, 1817	F (RA Dec.2009)			
Tytonidae				
<i>Tyto alba</i> (Scopoli, 1769)	V;A (U)	X	X	
Strigidae				
<i>Bubo virginianus</i> (Gmelin, 1788)	A (R)			
<i>Ciccaba albitarsis</i> (Bonaparte, 1850)	R;A (R)			
<i>Athene cunicularia</i> (Molina, 1782)	A;V (R)	X	X	
<i>Aegolius harrisii</i> (Cassin, 1849) ^{VU/LC}	A;V (R)			
<i>Asio stygius</i> (Wagler, 1832)	A;V (R)			
Caprimulgidae				
<i>Systellura longirostris</i> Bonaparte, 1825	R; V; A; M (U)	X	X	
Apodidae				
<i>Streptoprocne zonaris</i> (Shaw, 1796)	V (R)	X	X	X
<i>Aeronautes montivagus</i> (Orbigny & Lafresnaye, 1837)	V (R)			
Trochilidae				
<i>Colibri coruscans</i> (Gould, 1846)	R; V; M (C)	X	X	X
<i>Lesbia victoriae</i> (Bourcier & Mulsant, 1846)	R; V (C)	X	X	X
<i>Eriocnemis luciani</i> (Bourcier, 1847)	V (SV Mar.2012)			
<i>Patagona gigas</i> (Vieillot, 1824)	R; V; M (U)	X	X	X
<i>Myrtis fanny</i> (Lesson, 1838)	R; V; M (C)			X
<i>Chaetocercus mulsant</i> (Bourcier 1842)	R; V; M (R)	X	X	X
<i>Chlorostilbon melanorhynchus</i> Gould, 1860	R; V; M (R)			
<i>Amazilia tzacatl</i> (de la Llave 1833)	R; V; M (U)			X
Alcedinidae				
<i>Megaceryle torquata</i> (Linnaeus, 1766)	V (HC Dec.2013)			
Picidae				
<i>Colaptes rivolii</i> (Boissonneau, 1840)	R; V; M (U)	X	X	X
Falconidae				
<i>Falco sparverius</i> Linnaeus, 1758	V (U)	X	X	X
<i>Falco columbarius</i> Linnaeus, 1758	V (RA Dec.2009)			
<i>Falco peregrinus</i> Tunstall, 1771 ^{VU/LC}			X	
Furnariidae				
<i>Synallaxis azarae</i> Orbigny, 1835	R; V; A; M (C)	X	X	X

Continued

Table 1. Continued.

FAMILY Species ¹	Evidence ² Present study (relative abundance) ³	Trujillo and Trujillo (2002, 2003)	Ecuambiente Consulting Group (2007)	Lombeida (2009)
Tyrannidae				
<i>Elaenia albiceps</i> (Orbigny & Lafresnaye, 1837)	R; V; M (U)	X	X	X
<i>Camptostoma obsoletum</i> (Temminck, 1824)	R; V; M (U)	?		
<i>Anairetes parulus</i> (Kittlitz, 1830)	R (R)			
<i>Myiophobus fasciatus</i> (Statius Muller, 1776)	R; M (R)			
<i>Pyrocephalus rubinus</i> (Boddaert, 1783)	R; V; M (C)	X	X	X
<i>Myiotheretes striaticollis</i> (Sclater, 1853)	R (R)	X	X	X
<i>Tyrannus tyrannus</i> (Linnaeus, 1758)	V (JFF Apr.2011)			
<i>Myiarchus tuberculifer</i> (Orbigny & Lafresnaye, 1837)	V (JFF Aug.2009)			
Hirundinidae				
<i>Pygochelidon cyanoleuca</i> (Vieillot, 1817)	R; V; M (C)	X	X	X
<i>Orochelidon murina</i> (Cassin, 1853)		X	X	X
Troglodytidae				
<i>Troglodytes aedon</i> Vieillot, 1809	R, A; M (U)	X	X	X
Turdidae				
<i>Catharus ustulatus</i> (Nuttall, 1840)	V (R)			
<i>Turdus fuscater</i> Orbigny & Lafresnaye, 1837	V (C)	X	X	X
Mimidae				
<i>Mimus gilvus</i> (Vieillot 1808)	R; V; A; M (R)			
Thraupidae				
<i>Pipraeidea melanonota</i> (Vieillot, 1819)	V; M (R)			
<i>Pipraeidea bonariensis</i> (Gmelin, 1789)	R; V (U)	X	X	X
<i>Thraupis episcopus</i> (Linnaeus, 1766)	R (R)			X
<i>Tangara vitriolina</i> (Cabanis, 1850)	R; V; M (C)	?		X
<i>Conirostrum cinereum</i> Orbigny & Lafresnaye, 1838	R; V (U)	X		X
<i>Diglossa humeralis</i> (Fraser, 1840)			X	
<i>Diglossa sittoides</i> (Orbigny & Lafresnaye, 1838)	R; M (R)			X
<i>Phrygilus plebejus</i> Tschudi, 1844	R; V; M (C)	X	X	X
<i>Phrygilus alaudinus</i> (Kittlitz, 1833)	V; M (R)	X	X	
<i>Sicalis luteola</i> (Sparman, 1789)	V; M (R)	?		
<i>Sporophila luctuosa</i> (Lafresnaye, 1843)	R;V (R)			
<i>Sporophila nigricollis</i> (Vieillot, 1823)	R; M (R)			
<i>Catamenia analis</i> (Orbigny & Lafresnaye, 1837)	R; M (U)	X	X	X
<i>Catamenia homochroa</i> Sclater, 1859		X	X	
<i>Tiaris olivaceus</i> (Linnaeus, 1766)	R (R)			
<i>Tiaris obscurus</i> (Orbigny & Lafresnaye, 1837)	R (R)			
Incertae Sedis				
<i>Saltator striatipectus</i> Lafresnaye, 1847	R; M (U)			X
Emberizidae				
<i>Zonotrichia capensis</i> (Müller, 1776)	R; V; M (C)	X	X	X
<i>Atlapetes latinuchus</i> (Du Bus de Gisignies, 1855)	V (JFF Aug.2009)			X
<i>Atlapetes leucopterus</i> (Jardine, 1856)	V (R)			
Cardinalidae				
<i>Pheucticus chrysogaster</i> (Lesson, 1832)	R; V; M (U)	X	X	X
Parulidae				
<i>Myioborus melanocephalus</i> (Tschudi, 1844)				X
Fringillidae				
<i>Sporagra magellanica</i> (Vieillot, 1805)	R; V; M (C)	X	X	X
<i>Astragalinus psaltria</i> (Say, 1823)	R; M (R)			
<i>Euphonia cyanocephala</i> (Vieillot, 1819)	R (R)			X
Passeridae				
<i>Passer domesticus</i> (Linnaeus, 1758)	V (SV Jan.2012)			

¹ Conservation status according to IUCN: national classification (Granizo et al. 2002)/ global classification (IUCN 2013). Critically Endangered (CR); Endangered (EN), Vulnerable (VU), Near Threatened (NT) and Least Concern (LC).

² Evidence: R = mist nested; A = audio record; V = visual record; F = photography; M = Museum specimen; ? = visual records with not secure identification; X = referred in previous studies.

³ Relative abundance criteria: C = common, >10 individuals/day; R = rare, recorded in low numbers and not daily; U = uncommon, recorded daily in small numbers, 1–10 individuals/day; (observer acronym; date) = unique records which would indicate vagrant species; (V) uncommon, possible vagrant species.

(2.84 to 3.84 individuals/ha).

A number of species recorded are of special interest given their rarity or distribution. The Dark-billed Cuckoo, *Coccyzus melacoryphus*, was photographed at the BPJ in December 2009 by Roger Ahlman (<http://www.pbse.com/ahlman/image/120020742>). The Rufous-banded Owl, *Ciccaba albitarsis*, was audio recorded in October, November, and from February to April, and has at least two territories at the BPJ (one of them at La Caldera). The Buff-fronted Owl, *Aegolius harrisii*, was audio recorded in April–May 2012, and then in March 2013 when it was photographed. At least three territories of this species exist in the BPJ (one of them at La Caldera). We captured 37 individuals of the Purple-collared Woodstar, *Myrtis fanny*; 36 females identified by plumage and one juvenile male. Also, in May 2013 we captured an adult male of this same species at La Caldera. An individual of the Dusky-capped Flycatcher, *Myiarchus tuberculifer*, was seen and heard in August 2009. A group of 3–4 individuals of the Yellow-breasted Brush-finch, *Atlapetes latinuchus* was observed in August 2009, foraging with a mixed flock within a dense ravine. Two individuals of the House Sparrow, *Passer domesticus*, were seen in January 2012 at La Caldera. Also, HC and DB observed what seems to be a well-established resident population of this species at Alchipichi, a town 6 km (straight line) W from the BPJ.

We recorded several immatures (identified by plumage and mouth gap) between December 2012 and June 2013. We observed two juveniles of the Variable Hawk, *Geranoaetus polyosoma* flying together in June 2013, at La Caldera. Also, immatures of the following species were mist netted from December 2012 to May 2013 at the BPJ: nine Common Ground Dove, *Columbina passerina* (April–June); one *Myrtis fanny* (April); two Western Emerald, *Chlorostilbon melanorhynchus* (March and May); two Azara's Spinetail, *Synallaxis azarae* (April and May); eight Vermilion Flycatcher, *Pyrocephalus rubinus* (January–May); five Blue-and-yellow Tanager, *Pipraeidea bonariensis* (December–April); 11 Ash-breasted Sierra-Finch, *Phrygilus plebejus* (February–May); nine Band-tailed Seedeater, *Catamenia analis* (January–April); 17 Streaked Saltator, *Saltator striatipectus* (December–May); 43 *Zonotrichia capensis* (highest number in April [$n = 11$]); two Golden Grosbeak, *Pheucticus chrysogaster* (January–May, each one) and three Hooded Siskin, *Sporagra magellanica* (January and February).

DISCUSSION

We assume that species not reported in previous studies (see Trujillo and Trujillo 2002, 2003; Ecuambiente 2007; Lombeida 2009), were recorded herein because of a more thorough sampling effort of both diurnal and nocturnal birds. Five species (Andean Condor, *Vultur gryphus*; Brown-bellied Swallow, *Orochelidon murina*; Black Flowerpiercer, *Diglossa humeralis*; Paramo Seedeater, *Catamenia homochroa* and Spectacled Redstart, *Myioborus*

melanocephalus) previously reported at the BPJ (Trujillo and Trujillo 2002, 2003; Ecuambiente 2007; Lombeida 2009), were not recorded during our fieldwork. These species are normally found at higher elevations and/or wetter habitats (Ridgely and Greenfield 2001), but could descend occasionally or seasonally from the nearby slopes of Mojanda, north of the BPJ. The Peregrine Falcon, *Falco peregrinus* listed by Ecuambiente (2007) was not recorded during fieldwork, but it is known to breed in the Guayllamba valley (Granizo et al. 2002).

Other species mentioned in previous studies (Ecuambiente 2007; Lombeida 2009) are not included in our list (Table 1) because of the absence of tangible evidence, such as photographs, recordings, or specimens, or the possibility that inclusion in their lists resulted from misidentifications. The Dark-backed Wood-Quail, *Odontophorus melanonotus* and the Gorgeted Woodstar, *Chaetocercus heliodor* were not included because they are known to inhabit cloud forests of the western Andean foothills, and with no records at any other Andean dry forest through their range. The Gray-browed Brush-Finch, *Arremon assimilis*, the White-banded Tyrannulet, *Mecocerculus stictopterus*, and the Mountain Wren, *Troglodytes solstitialis*, are also species of humid forests at a higher elevation than those of the BPJ, while the Paramo Pipit, *Anthus bogotensis*, has only been reported in pastureland in the highlands above 3000 m altitude. Finally, the Turquoise-throated Puffleg, *Eriocnemis godini* has not been registered in more than 150 years, even after intensive searches in Andean forest remnants and scrub in the Guayllabamba River Valley (Ridgely and Greenfield 2001; Freile et al. 2004). Although any record of this enigmatic species is valuable, we believe that it is necessary to substantiate any observation to avoid misinterpreting the actual situation of the species, which is possibly extinct (however, see Graves 1996 for a discussion on its taxonomic validity).

Previous data on species of special interest is summarized and discussed, as follows. The status of the *Coccyzus melacoryphus* in the inter-Andean valleys is unclear; some individuals registered in Ecuador apparently belong to the austral migrant population, while others suggest that there is a resident population (Ridgely and Greenfield 2001). *Aegolius harrisii* is rare throughout its range (Granizo et al. 2002), but may be overlooked given its secretive habits (König and Weick 2008); there are only nine records in Ecuador that fall in the elevation range of 1,900–3,100 m in the high temperate and subtropical regions of both Andean slopes (Ridgely and Greenfield 2001). The predominance of females over males in the net catches of *Myrtis fanny*, could be caused by differences in mobility in the study area (i.e., females may move more in search of food and nesting material). Observations and capturing of *Passer domesticus* must be taken into account for future monitoring efforts; this European species has been introduced in South

America in many occasions, with the oldest introduction recorded for 1872 in Buenos Aires (Ortiz-Crespo 1977), and has been widely dispersed in the Andes and Pacific coast south of Colombia (IUCN 2013). Finally, three species, *Ciccaba albitarsis*, *Myiarchus tuberculifer*, and *Atlapetes latinuchus*, were not previously reported in the area and are usually found in subtropical and temperate forest (Ridgely and Greenfield 2001). However, while the *Myiarchus tuberculifer* and the *Atlapetes latinuchus* are probably wanderers, *Ciccaba albitarsis* occupies what seems to be well-established territories at the BPJ, and it has also been found defending territories at semi-humid woodland at El Tingo and Cochasquí, Pichincha prov. (JFF, unpubl. data). Unfortunately, data provided in this work are insufficient to portrait a temporal pattern of reproduction, if there is one.

Records off known elevational limits as reported by McMullan and Navarrete (2013) are noted in parentheses, as follows: *Cathartes aura* (<2,000 m); *Coccyzus melacoryphus* (<1,600 m); *Bubo virginianus* (>2,600 m); *Eriocnemis luciani* (>2,900 m); *Megaceryle torquata* (<1,500 m); *Myiophobus fasciatus* (<1,700 m but can reach up to 2,500 m in southern Ecuador); *Myiarchus tuberculifer* (<1,700 m this species may reach up to 2,500 m, but in southern Ecuador [Ridgely and Greenfield 2001]); *Tiaris obscurus* (<1,500 m); and *Tiaris olivaceus* (<1,800 m). Finally, *Amazilia tzacatl* (<1,600 m) was suggested as seasonal at the Inter-andean valleys above 2,000 m elevation by Ridgely and Greenfield (2001), but according to our records it should be considered a permanent resident of the Guayllabamba valley.

The Guayllabamba River Valley is an IBA, because it is the only place where *Eriocnemis godini* has been collected; this species is critically endangered and has no confirmed records since 1850 (Freile and Santander 2005). A location in this valley (above Perucho) is the only known collection site of this species, since other specimens have inaccurate collection locality information (i.e., locality labeled as Ecuador or Bogotá only; BirdLife International 2015). Other species of national conservation concern include *Aegolius harrisii*, ranked as Vulnerable (Granizo et al. 2002), for which the BPJ apparently houses a small resident population. Additionally, *Falco peregrinus*, also Vulnerable in Ecuador, has a breeding population in this valley (Granizo et al. 2002).

On the other hand, La Caldera is an inaccessible depression that lies outside the BPJ, but probably has a high conservation value, including territories of *Ciccaba albitarsis* and *Aegolius harrisii*. Addition of La Caldera to the BPJ would be important for the conservation of populations of these and other species. Also, because of the high quality of its habitat, it may be a source of seeds for populations of plants and animals at the BPJ, and is home for the populations of six species of endemic flora of Ecuador (Albuja 2011). Besides, it is a refuge for

mammals up to the size of the Andean fox (*Lycalopex culpaeus*) that feed and live in the BPJ (Trujillo and Trujillo 2007).

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